

RESPONSE TO RESEARCH REVIEW TEAM DATA REQUEST NOAA/OAR AERONOMY LABORATORY

7 February 2004

1. MOST RECENT LABORATORY REVIEW

The most recent review of the Aeronomy Laboratory was conducted in September, 1998. This OAR-sponsored review involved three external scientific reviewers. A pdf file of the reviewer comments has been provided separately.

2. BRIEF MISSION AND HISTORY OF THE AERONOMY LABORATORY

The Aeronomy Laboratory Mission: Understanding Atmospheric Processes Related to Climate, Ozone Layer, and Air Quality. The Aeronomy Lab has always been a "process laboratory." Namely, *our mission is to improve the understanding of the chemical and related processes in the Earth's atmosphere that are needed to improve NOAA's capability to predict its behavior.* The chemical, dynamical, and radiative processes of the atmosphere are the mechanisms of atmospheric change. As such, their identification and characterization are a fundamental necessity for building better models for predicting the behavior of global and regional phenomena, which is at the heart of NOAA's information mission.

- Foci. The Aeronomy Laboratory currently focuses on understanding the atmospheric processes important to model predictions of changes in climate, regional air quality, and the stratospheric ozone layer.
- Approach. In this user-information context, Aeronomy Lab scientists conduct investigations of the atmospheric process under controlled conditions in the laboratory, carry out field measurements in a variety of environments, and use diagnostic models for analyses and interpretations.
- Connection to the customer. The Aeronomy Laboratory also assesses the current state of scientific understanding and interacts with those who use this information, both within NOAA and elsewhere.

Brief History of the Aeronomy Laboratory: Redirection to Meet the Changing Needs of the Nation for Information about the Atmosphere. The Aeronomy Lab was formed in 1965. Over the Aeronomy Lab's nearly 40-year time span, its research has evolved to meet a sequence of most-pressing national needs for scientific understanding of atmospheric chemistry and related air motions associated with NOAA's information mission. The Lab initially focused on the chemistry and dynamics of the upper atmosphere's ionosphere, in response to the Nation's need for scientific information that would enable advances in radio communications and matters of national security. In the 1970s, the Aeronomy Lab's research shifted to the chemistry of the lower layers of the atmosphere as the national environmental issues of stratospheric ozone depletion and acidic deposition emerged. Over the recent decade, the Aeronomy Lab's research foci have included the chemical processes that control the radiative characteristics of greenhouse gases and aerosols in the lower atmosphere and that control surface-level ozone pollution episodes. All of this multi-decadal sequence of redirection has been self-instigated by the Lab and its staff, who see the societal needs for insights on emerging environmental issues.

3. MAJOR CUSTOMERS OF THE AERONOMY LABORATORY

Our “Information Customers”: **Serving a Broad Customer Base by Providing Scientific Information Associated with Pressing Environmental Issues.** The Aeronomy Laboratory’s customer base includes a wide spectrum of organizations. Examples of each are given below.

Other OAR Laboratories and Centers. The understanding of processes is required input that helps other OAR Labs meet their missions and vice versa. Examples include:

- The Aeronomy Lab’s chemical-process understanding brings interpretive insight to the trace-gas monitoring records of the Climate Diagnostics and Monitoring Lab (CMDL),
- The synergy of the chemical/spectrographic measurements of the Aeronomy Lab and the suite of meteorological measurement methods of the Environmental Technology Lab,
- The process characterizations of the Aeronomy Lab is required input to improvement of the global climate modeling focus of the Geophysical Fluid Dynamics Lab (GFDL) and the regional air quality forecast modeling focus of the Air Resources Lab (ARL).

Within NOAA. The Aeronomy Lab’s understanding of chemical processes has long been an input to the understanding of the behavior of stratospheric ozone trends of the National Environmental Satellite, Data, and Information Service (NESDIS) and similarly for the stratospheric temperature trends of the National Weather Service (NWS). Over the last 15 years, the Aeronomy Laboratory’s research has resulted in a process-level understanding of factors that contribute to surface-level air pollution. This understanding has formed the foundation for an emerging new service now being developed in OAR and NWS, namely, an air quality forecasting capability. Further, Aeronomy Laboratory research results that elucidate global phenomena are part of the information portfolio of the new NOAA-wide Climate Program.

Governments. In addition to helping strengthen the science related to climate, the ozone layer, and air quality, a hallmark of the Aeronomy Lab has focused on also assisting with periodic assessments of the state of the science on these three topics, which lies at the heart of NOAA’s role as an environmental information service. These assessments serve as scientific, decision-support input to those required to make policy decisions with regard to environmental issues and the public welfare. Aeronomy Lab staff have helped and are continuing to help by serving in a variety of roles with the Intergovernmental Panel on Climate Change (IPCC) Science Working Group and the ozone-layer assessment for the U.N. Montreal Protocol.

Industry. In addition to the state-of-science assessments noted above, the Aeronomy Laboratory research results are important direct decision-support input to industry. A notable example is the long-standing evaluation of potential substitutes for the now-banned ozone-depleting chemical compounds. Costly “false steps” by industry were avoided by early “heads -up” information about the ozone-friendliness of new candidate compounds.

The public: Everyone’s ultimate “customer.” The Aeronomy Lab has increasingly focused on the challenging task of taking the results of science to the public in user-friendly terms. “The public” is, of course, a very diverse part of the “customer” spectrum, thereby necessitating a rather “broad-band transmission”. Examples of the Lab’s outreach communication goal are: (i) cochairing the less-technical Executive Summaries that are key parts of scientific assessments,

(ii) pioneering the booklet "*Frequently Asked Questions About Ozone*", which has become a regular feature of assessments of the science; and (iii) describing the understanding of environmental issues in schools, town meetings, and local clubs.

With this "end-to-end" focus that goes from scientific discovery to facilitation of the utilization of environmental "news-you-can-use", the Aeronomy Lab is contributing to all steps of the process that leads to an effective *science information service*, which is NOAA's core mission.

4. SUMMARY OF RESEARCH AT THE AERONOMY LABORATORY

Overview: Three Major Scientific Issues, and an Overarching Role in Science

Communication. The Aeronomy Lab's research is aimed at understanding the atmospheric processes important to model predictions of changes in climate, the stratospheric ozone layer, and regional air quality. Scientists at the Aeronomy Lab play leading roles in producing "state-of-the-science" assessment reports for use by national and international decision makers.

Relationship to the NOAA Strategic Plan: At a Glance. The Aeronomy Laboratory's research contributes to three primary Programs in two of the Goals in the NOAA Strategic Plan:

- *Climate Goal* - The focus of approximately 70% of the Lab's research, primarily the Climate Forcing Component, with some research in the Observations and Analysis Component.
- *Weather and Water Goal* – The focus of approximately 30% of the Lab's research occurs in the Air Quality Program of this Goal.

A Closer Look: Climate Research Themes at the Aeronomy Laboratory

The Aeronomy Lab's climate research contributes toward an improved understanding of: (i) the chemistry, radiation, and dynamics of climate, and (i) the depletion of the stratospheric ozone layer. Major themes are:

Laboratory and field measurements of non-CO₂ climate-related species, notably aerosols and tropospheric ozone. The Aeronomy Lab carries out laboratory experiments and focused field studies to investigate the chemical-transformation processes associated with the global transport and distribution of climate-related emissions, particularly those related to the shorter-lived, non-CO₂ species: tropospheric ozone and aerosols. The data (airborne, ground-based, and shipboard) and correlations among species are input to diagnostic analyses that identify and characterize processes associated with natural and human influences. The current emphasis is a major collaborative field mission in summer 2004 that will examine processes associated with the cross-Atlantic transport and transformation of radiatively important species from eastern North America to Europe. **PAYOFFS:** This research is yielding (i) observation-based information that will evaluate and improve the simulation of the link between emissions and the radiative forcing of climate, (ii) a characterization of the processes that determine how emissions from continents (e.g., North America and Asia) can contribute to the global chemical and radiation balance, and (iii) input to broader suite of non-CO₂ decision-support options. All of these are designed to be input to the NOAA-led Climate Change Science Program 2007 deliverable on aerosols and climate and to the 2007 assessment report of the IPCC.

Field and laboratory studies, theoretical analyses, and diagnostic modeling to characterize the globally-occurring chemical and dynamical processes that affect the radiative balance of the coupled ozone-layer and climate system, especially with respect to trace constituents, aerosols, water vapor, and clouds. The aim of this research is to identify, observe, and simulate the global, climate-related interactions between chemistry, clouds, and radiation. Laboratory experiments quantify the chemical and optical molecular properties and processes that determine the atmospheric lifetimes, abundances, and trends of greenhouse gases and aerosols, as well as their precursors. Upper troposphere, lower stratosphere airborne experiments using a high-altitude research aircraft (in partnership with NASA) are contributing to an emerging characterization of these coupled regions that figure strongly in the Earth's radiation balance. In addition, spectroscopic field measurements and diagnostic models are defining the reflectivity of cloud tops and cloud liquid-water abundances. PAYOFFS: These direct observations, laboratory studies, and diagnostic analyses are characterizing the radiative-forcing parameters needed for better simulations of future climate variation and change. They will, therefore, provide new process characterization to the model simulations for the U.S. Climate Change Science Program 2007 deliverables and for the 2007 assessment report of the IPCC.

Understanding the relationships between tropical dynamics and climate variability. The goal of this research is to analyze data and conduct theoretical studies to improve understanding of (i) dynamical processes in the tropical Pacific Ocean region related to subseasonal, seasonal, and interannual atmospheric variability, and (ii) atmospheric circulation, convection, and moisture and heat budgets associated with the El Niño phenomenon. Wind profiler and radiosonde data are combined with reanalysis products to examine circulation, convection, marine boundary layer winds, and moisture/heat budgets. A current emphasis is on the processes associated with precipitation, particularly the dynamical links between tropical rainfall, large-scale atmospheric circulation, and extratropical climate. PAYOFFS: Improved prediction of the intraseasonal phenomenon; enhanced understanding of the role of tropical convection and circulation patterns in global meteorology; improved ability to forecast El Niño events and to understand other interannual climate fluctuations that have their origin in the tropics.

Laboratory and field investigations of the chemical processes related to depletion of the stratospheric ozone layer. The aim of this research is to advance the understanding of the photochemical and dynamical processes that influence the ozone layer and to enable better predictive capability regarding the expected future recovery of the ozone layer. Laboratory experiments characterize the rates and products of chemical reactions associated with ozone loss. A current emphasis is on assessing the new substances that are proposed by industry as marketable substitutes for the now-banned ozone-depleting substances. Field studies using high-altitude research aircraft (with NASA) are carried out in a variety of global locations and during various seasons to characterize the processes important to ozone chemistry. The current focus is on the analysis and conclusions from the now-substantial dataset for the northern high latitudes in winter and for tropical latitudes. PAYOFFS: The improved process information is critical to the building of predictive capabilities that can better assess potential future perturbations (e.g., expanded aircraft fleets) on the recovery of the ozone layer, in the context of natural variation. The research will help to meet the information needs of the 2006 scientific assessment report of the Montreal Protocol. Establishing the "ozone friendliness" of proposed substitutes prior to their industrial development is like serving as an "FDA" of proposed ozone-related chemicals.

A Closer Look: Air Quality Research Themes at the Aeronomy Laboratory

Regionally focused air quality field studies and diagnostic analyses. In this research, the Aeronomy Lab carries out atmospheric observations and diagnostic analyses that characterize the chemical and meteorological processes involved in the formation of pollutant ozone and fine particles on regional scales. The work is focused on regions of the U.S. that are experiencing high levels of pollution and that, as a consequence, need firm scientific information that will help them to identify the approach that will be most effective in improving the air quality of that region. In summer 2004, the Aeronomy Lab is playing a leading role in a major, highly collaborative study of air quality in the New England region. Theoretical studies and diagnostic analyses are aimed at characterizing the atmospheric processes that are needed for improvement of air quality simulations and forecasts, now under development as the newest addition to NOAA's portfolio of predictive capabilities. **PAYOFFS:** The quality of this observation-based information is changing the approach to defining clear air objectives, e.g., demonstrating that the "chemical diversity" across the U.S. implies that "one size does not fit all" in either air quality forecasting or in regulatory approaches to cost-effective air quality improvements.

Laboratory investigations of air-quality chemical reactions. This research applies laboratory analytical methods to quantify photochemical reactions that transform emissions (e.g., nitrogen oxides and organic compounds) into pollutant species, both gases and particles. A current focus is on studying nighttime chemical transformations, a heretofore poorly understood aspect of the chemistry that influences air quality. A new detection technique has made it possible to study for the first time the reactive nitrogen species that are important in this nighttime chemistry. **PAYOFFS:** These reaction-rate data are the key input upon which the accuracy of the predictions of air quality forecast models depend.

A Closer Look: Cross-Cutting Assessment Theme of the Aeronomy Laboratory

Scientific information for decision support: Climate change, ozone-layer depletion, and air quality. Aeronomy Lab scientists plan, lead, prepare, and review state-of-science assessments for the decisionmaking communities associated with ozone-layer depletion, greenhouse warming, and regional air quality. Current foci are on: (i) the 2007 report of the Intergovernmental Panel on Climate Change (IPCC), (ii) the 2006 report of the UNEP/WMO Ozone Science Panel of the Montreal Protocol, and (iii) the emission-inventory assessments by the U.S., Canada, and Mexico. Aeronomy Laboratory scientists serve as international cochair of two of these major international endeavors: the IPCC science working group and the Montreal Protocol Science Panel. Aeronomy Laboratory researchers serve as Lead Authors, Coauthors, Contributors, Reviewers, and Coordinating Editor of the assessments. **PAYOFF:** These endeavors have come to be the key mechanism for transferring vetted and synthesized research information to those who must make environmental decisions related to human welfare.

B. Geographic Scope of the Research at the Aeronomy Laboratory

The Aeronomy Lab's climate research has global scope and implications. Recent climate studies have focused on the Pacific-to-U.S. West Coast region, North America/North Atlantic, and the tropical Pacific. The ozone-layer research has involved projects that spanned "from pole to pole and points in between," from Antarctica to the northern polar region.

The Aeronomy Lab's air quality research has a U.S./regional geographic scope. The focus here is on those regions of the Nation that are experiencing poor air quality and that are looking for scientific information that will help regional decisionmakers identify the most effective and efficient approaches to improving air quality. To date, studies have been carried out in Texas, Alabama, Tennessee, Georgia, Illinois, and the New England region.

C. Time Frames for Aeronomy Laboratory Research

Within the framework of its mission, the Aeronomy Lab largely takes the long view in its research planning and commitments, thereby embracing the evolving information needs in all three of what the Lab sees as the “phases” of an environmental issue: credibility, manageability, and accountability. For example, in the two-decade focus on the stratospheric ozone depletion, the Lab has provided scientific input to the sequence of policy-support questions in each phase: “Is this a real issue?”; “How are the options for solving it?”; and “Are actions yielding the intended improvement?”. For climate and air quality, we see the same needs for an *evolving sequence of 2 – 4 year projects* (e.g., “What is a method for measuring the absorption and scattering, simultaneously and in-situ, of aerosols in the “real” atmosphere?” and “Why did the air quality forecast miss or agree with the peak surface ozone levels”) *within the context of decadal “staying-power”*.

5. MAJOR ACCOMPLISHMENTS (1998-2003) OF THE AERONOMY LABORATORY

Scientific Accomplishments:

Advancing in Scientific Understanding About the Processes in Earth's Atmosphere

(1) The global and polar ozone layer: Making scientific discoveries that underpin predictions of the ozone layer's future recovery

Major accomplishments. Aeronomy Lab scientists are focusing not only on characterization of ozone-destruction processes, but also to helping “find the way out” with the evaluation of new substances being developed for societal uses. Recent accomplishments include:

- The Aeronomy Lab has helped develop a new area of atmospheric-chemistry research that was, in large part, spawned by earlier Aeronomy Lab discoveries about the cause of the Antarctic ozone hole. Namely, “heterogeneous chemistry,” which studies the interaction of gases with particles in the atmosphere such as the polar stratospheric clouds (PSCs) or particles formed from volcanic emissions. This research has pointed out how these new processes help explain not only year-to-year variations, but also long-term trends.
- Aeronomy Laboratory research in 2002/2003 has shown that it is the Antarctic ozone hole, not “global warming” that is the cause of anomalous temperature trends now occurring at the surface of the Antarctic continent (a definitive ozone layer/climate connection).
- The Aeronomy Lab is a leader of current research in developing approaches to assess the ozone friendliness of a new class of very short-lived substances (days-to-weeks), which industry has turned to as alternatives to ozone-depleting substances.

Users and benefits. This research has provided the scientific basis for national and international decisions to protect the ozone layer, namely, the U.S. Clean Air Act and the U.N. Montreal

Protocol on the ozone layer. Those decisions have been directly credited with global achievements in dramatically curtailing the use of ozone-depleting substances. The initial expectations of runaway depletion of the ozone layer have been transformed by these agreements into expectations of recovery of the stratospheric ozone layer by the middle of the 21st Century. An ultimate, and perhaps incalculable, benefit to the U.S. taxpayer and to citizens worldwide is the protection of the public from detrimental effects of exposure to ultraviolet radiation that would have occurred with a thinner ozone layer. Estimates are that without the Protocol, an additional 1.5 *million* skin cancer cases would occur *per year* in the U.S. alone.

(2) Elucidating the chemistry that underlies the radiative properties of the atmosphere.

Major accomplishments. The Aeronomy Lab is focusing on the atmospheric chemical processes that underlie the radiative properties of the atmosphere. Some recent examples are:

- Using new and past observations, determined that tropospheric ozone levels in air coming ashore at the U.S. West Coast has increased by about 30% near the surface over the past two decades, demonstrating that, alas, a “natural,” unperturbed Pacific Basin no longer exists. The increase in this greenhouse gas influences the radiative forcing of climate, and also has implications for the regional air quality on the U.S. West Coast.
- Expanded the understanding of the absorption properties of water vapor. This Aeronomy Lab research has enabled a more precise determination of the amount of incoming solar radiation absorbed by the atmosphere, and hence contributes to improved understanding and simulation of the Earth's radiation balance.
- Developed and applied a new measurement method to provide real-time, in-situ analysis of the chemical composition of *individual* atmospheric particles, a first-time capability in the atmospheric sciences. Field measurements using the method have provided new information about the chemical makeup of atmospheric particles that are effective in causing cloud formation. The result that sulfate particles (the most common type) are poor cloud-condensation nuclei, runs counter to existing scientific preconceptions and brings a new accuracy to the modeling and prediction of cloud formation processes.

Users and benefits. This increasing aerosol-climate focus of Aeronomy Laboratory research is helping to reduce a major uncertainty in climate science. It is deemed to be one of the Nation's top three research priorities by the U.S. Climate Change Science Program (CCSP). Because aerosol lifetimes are relatively short in the atmosphere, this research is contributing to the development of potential options that could reduce the radiative forcing of climate in the coming decade or so. Further, since aerosols are also a growing human-health issue, this research is helping identify potential “win-win” options in climate and air quality.

(3) The Aeronomy Laboratory's regional air chemistry discoveries: Setting a course for developing a new NOAA air quality forecasting service.

Major accomplishments. The “discovery-to-operations” air quality accomplishments of the Aeronomy Lab span over three decades. Earliest Aeronomy Lab work in the 1970s and 1990s revealed the significance of natural sources in the chemistry that produces acid rain and surface-level ozone pollution, thereby helping decisionmakers avoid costly miscues in the actions taken (i.e., “working against Ms. Nature”). Then, beginning in the late 1990s, the Aeronomy

Laboratory's air quality research has continued to show that one must "expect the unexpected" on this scientific topic: Contrary to the then-common policy approach, the factors that govern air quality for one area of the country are not necessarily the same as the factors that are at work in another area ("one size does not fit all"). Most recently, the Aeronomy Lab diagnostic regional studies have yielded findings of practical and very immediate use to developing regional air quality forecasting:

- *In the eastern U.S.:* Smaller coal-fired electric-generating power plants produce more ozone pollution per unit of power generated than do larger power plants, a finding that has implications for future design decisions of the energy industry. Further, Aeronomy Laboratory research demonstrated that the pollution per unit power also depends on the ambient chemical background of the air in the region of the power plant, and therefore the location of the power plant is a factor (i.e., "location, location, location").
- *In the New England region:* Nighttime chemical processes, as well as coupling between land and offshore processes, are more important to the region's ozone pollution than mid-west emissions, and incorporation into air quality models will lead to improved forecasts.
- *In the Houston region:* Fugitive emissions (leaks) from the petrochemical industry are a much, much larger influence on the region's air quality than had been previously estimated, a result that has altered greatly the policy approach taken by Texas air quality managers (at a savings of 70,000 jobs and \$10B by the year 2010 in Texas). As noted by the Deputy Director of the Texas Commission on Environmental Quality (the lead environmental agency for the State of Texas) in a 9 September 2003 letter to VADM Lautenbacher, "NOAA's discoveries during the 2002 Texas study have allowed for the development of cost-effective strategies that will result in cleaner air."

Users and benefits. The discoveries of the Aeronomy Lab's atmospheric-chemistry process studies have enabled the nation's air quality management efforts to become both more effective and more cost efficient. Further, the cumulative process-level understanding from this research is laying the scientific groundwork for developing an air quality forecasting capability within NOAA, since model forecasts are only as good as their representativeness of the "real" atmosphere. This joint OAR/NWS effort is expected to culminate fully into an operational air quality forecast service within this decade and the progression is a major example of the "discovery-to-operations" path. Such forecasts will protect the public from the harmful health effects of exposure to poor air quality (e.g., in susceptible populations like asthmatics), which will translate into benefits and savings for the nation's citizens and businesses.

***Assessment and Accomplishments:
Translating Research Findings into Decision Support Information***

(4) Leadership in delivering information products to decisionmakers on the ozone layer, climate, and air quality: Scientific state-of-understanding assessments.

Major accomplishments. A hallmark of the Aeronomy Lab is its special emphasis on communicating discoveries, predictions, and other scientific information in a form that meets the needs of end users in government, industry, and international relations. The Aeronomy Lab, by design, is at the "dialogue interface" between researchers and information users. It helps provide

the information service of periodic international state-of-scientific-understanding updates (“assessments”) on the topics of the stratospheric ozone layer, climate, and air quality.

- The Aeronomy Lab has led the international ozone-layer assessments since their inception:
 - An Aeronomy Laboratory scientist has served as Cochair (since 1989) of the ozone-layer assessments, which have occurred in 1989, 1991, 1994, 1998, and 2002 (forthcoming assessment in 2006). In this capacity, the Aeronomy Lab has interacted throughout each year with governments and industry to learn their needs and has then described and presented the findings of the assessments to the over 170 nations that are Parties to the international ozone-layer agreement (the United Nations Montreal Protocol on Substances that Deplete the Ozone Layer) and world industry leaders.
 - Aeronomy Laboratory scientists have made extensive contributions as leading authors, coauthors, contributors, peer reviewers, and coordinating editor throughout the ozone-layer assessment’s history (most recently in the 2002 assessment).
- The Aeronomy Laboratory has had an increasing role in the international climate assessments of the Intergovernmental Panel on Climate Change (IPCC). In addition to continuing roles as authors, contributors, and reviewers, Aeronomy Laboratory scientists have more recently added these high-profile roles: (i) the lead authorship of the widely read *Summary for Policymakers and Technical Summary* of the 2001 assessment report, and (ii) the election in 2002 of an Aeronomy Laboratory scientist to Cochair of the IPCC’s scientific working group, whose Technical Support Unit is housed at the Aeronomy Laboratory. The IPCC has begun its preparation of the 2007 Fourth Assessment Report.
- Aeronomy Lab scientists have also been steering committee members, lead authors, and reviewers of the international scientific assessments on the air quality topics of surface-level ozone and fine-particle pollution, as well as the atmospheric effects of aviation.

Users and benefits. The Aeronomy Lab’s cumulative (15-plus years) contribution has forged a “blueprint” for the global and regional scientific assessment process. These assessments are key products in NOAA’s information-providing mission. Through its leadership in scientific assessments since their very inception with the ozone-layer issue, the Aeronomy Lab ensures that NOAA’s research findings (and, indeed, the world’s) reach decisionmakers in a timely, user-friendly format to meet their information needs with regard to societal decisions on the ozone layer, climate, and air quality. As noted by public policy expert Edward A. Parson (Harvard) in his 2003 book *Protecting the Ozone Layer*, “...statements in official scientific assessments did move major actors to change positions, resolve debates over contested policy-relevant claims, and stimulate the formation of policy coalitions.” The scientific basis of decisions is enhanced through this end-to-end, cyclic information service, thereby providing “one-stop shopping” for information on issues, serving as a “touchstone” of credibility, and ultimately sparing the taxpayer the expense of unnecessary or ineffective actions.

***Program Accomplishments:
Helping Make NOAA Greater Than the Sum of Its Parts***

(5) Leadership in fostering scientific and program “interconnectiveness” within NOAA

Major accomplishments. The Aeronomy Lab has initiated and helped lead many research efforts that involve multiple entities within NOAA. Earliest efforts focused on gaining synergies

through partnerships with several laboratories within OAR. The Lab-initiated and -led Radiatively Important Trace Species (RITS) research program of the 1980s was, along with the Tropical Oceans and Global Atmosphere (TOGA), was the forerunner of the NOAA Office of Global Programs. The Lab-initiated and -led Health of the Atmosphere program that began in the late 1990s began laying the inter-Laboratory foundations of NOAA's air quality research. Examples of recent organization efforts and leadership include:

- An Aeronomy Laboratory scientist serves as Program Manager of the Climate Forcing component of NOAA's matrix Climate Program
- An Aeronomy Laboratory scientist serves as the Program Manager of the matrix Air Quality program under the Weather and Water goal of NOAA's Strategic Plan.

Benefits and Users. These examples illustrate the commitment of the Aeronomy Lab to “work larger than itself” in the NOAA efforts to strengthen the research and service enterprise of the organization through a greater interconnectedness of its Labs, Centers, and Line Offices. The Aeronomy Lab leadership in these areas has the additional benefit of helping to position NOAA as a lead agency in the Nation's interagency activities in climate (i.e., the U.S. Climate Change Science Program – Atmospheric Composition Co-chair) and air quality (i.e., the Federal Air Quality Research Subcommittee – Chair for the past decade).

6. LEGAL MANDATES FOR THE WORK OF THE AERONOMY LABORATORY

Climate Research: Global Change Research Act of 1990 (Public Law 101-606). This mandate require the Agencies (including NOAA) to carry out “research on the interactions of natural and human-caused changes in the global environment and their implications for society.” The Aeronomy Lab helped lead the drafting of the research plan for the U.S. Global Change Research Program (1990) and has done the same for the successor, the Climate Change Science Program. An example of a current requirement on the Lab is the co-lead responsibility (with NASA) for the 2007 decision-support assessment product, “Aerosol and Climate”.

Stratospheric Ozone-Layer Research: Public Law 95-95, Clean Air Act Amendments, 1990. NOAA (and NASA) is required to “...continue programs of research, technology, and monitoring of the phenomena of the stratosphere for the purpose of understanding the physics and chemistry of the stratosphere and for early detection of potentially harmful changes in the ozone in the stratosphere...” and report on advances in understanding.

Air Quality Research: (i) H.R. 4 Energy Policy Act of 2002 (Senate Amendment) S. 517, Part II, Section 1383, Forecasts and Warnings. “The Secretary of Commerce, through the Administrator of the NOAA, shall, in order of priority as listed in section (c), conduct regional studies of the air quality within specific regions of the United States. Such studies should assess the (i) effects of in situ emissions of air pollutants and their precursors, (ii) transport of such emissions and precursors from outside the region, and (iii) production of air pollutants within the region via chemical reactions, ... and shall establish a program to provide operational air quality forecasts and warnings ...” ***(ii) Memorandum of agreement between NOAA and EPA (May 2003).*** Expands the NOAA-EPA formal cooperative research agreement to include air quality forecasting. NOAA deliverables include improved air quality forecast models and air quality forecast assessment. EPA deliverables include providing emissions inventory and monitoring.